UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/922,442	08/03/2001	Ying-Chang Liang	1085-027-PWH	1355

21034 7590 02/17/2006

IPSOLON LLP
111 SW COLUMBIA
SUITE 710
PORTLAND, OR 97201

EXAMINER	
GENACK, MATTHEW W	

ART UNIT	PAPER NUMBER
2645	

DATE MAILED: 02/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/922,442	Applicant(s) LIANG ET AL.	
	Examiner Matthew W. Genack	**Art Unit** 2645	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 October 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12,14,15,17 and 18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12,14,15,17 and 18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 August 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Youssefmir *et. al.*, U.S. Patent No. 6,141,567.

Regarding Claim 1, Youssefmir *et. al.* discloses a method for adaptively constructing downlink signals in a frequency division duplex wireless communication system that comprises a base station with a smart antenna array and a plurality of remote terminals (Abstract, Column 3 Line 66 to Column 4 Line 6, Column 4 Lines 32-37, Column 5 Line 64 to Column 6 Line 5). The base station smart antenna array receives combinations of uplink signals from the plurality of remote terminals (Column 6 Lines 12-16, Fig. 1). The uplink beamforming weight vector for a given remote terminal is estimated based on received uplink signals (Column 6 Lines 12-32, Column 10 Lines 24-34, Column 11 Lines 28-56). Uplink nulls and the uplink main beam position are identified from the uplink weights (Column 4 Lines 19-28, Column 18 Lines 4-10). Uplink null and beam information are used to appropriately place downlink nulls and in the computation of downlink beam weights (Column 17 Line 37 to Column 18 Line 10).

A set of information signals is transmitted from the base station in accordance with the downlink beam weights (Column 3 Lines 20-23, Column 5 Line 64 to Column 6 Line 5).

Regarding Claim 7, Youssefmir *et. al.* discloses a method for adaptively constructing downlink signals in a frequency division duplex wireless communication system that comprises a base station with a smart antenna array and a plurality of remote terminals (Abstract, Column 3 Line 66 to Column 4 Line 6, Column 4 Lines 32-37, Column 5 Line 64 to Column 6 Line 5). The base station smart antenna array has a uniform spacing between elements (Fig. 2). The base station smart antenna array receives combinations of uplink signals from the plurality of remote terminals (Column 6 Lines 12-16, Fig. 1). The uplink beamforming weight vector for a given remote terminal is estimated based on received uplink signals (Column 6 Lines 12-32, Column 10 Lines 24-34, Column 11 Lines 28-56). Uplink nulls and the uplink main beam position are identified from the uplink weights (Column 4 Lines 19-28, Column 18 Lines 4-10). Uplink null and beam information are used to appropriately place downlink nulls and in the computation of downlink beam weights (Column 17 Line 37 to Column 18 Line 10). A set of information signals is transmitted from the base station in accordance with the downlink beam weights (Column 3 Lines 20-23, Column 5 Line 64 to Column 6 Line 5).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 2 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Youssefmir *et. al.* in view of Bakhru, U.S. Patent No. 4,173,759, further in view of Dent, U.S. Patent No. 5,555,257.

Regarding Claim 2, Youssefmir *et. al.* discloses every limitation of Claim 1, upon which Claim 2 depends, as outlined above.

Youssefmir *et. al.* does not expressly disclose the categorization of uplink nulls into good uplink nulls and bad uplink nulls, nor the reassignment of said bad uplink nulls in such a way as to form corrected uplink nulls.

Bakhru teaches that a problem encountered with certain antenna arrays is the existence of a null in the exact direction that an information signal is being received (thus, an uplink signal) from, and that the disclosed invention remedies this problem (Column 1 Lines 39-46). In the disclosed invention, the antenna array's receiving pattern is steered so that the nulls are not in the direction of the desired information signal, but rather in the direction of sources of interference, and the main lobes are in the direction of the desired information signals (Column 2 Lines 31-41).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* by identifying unwanted uplink nulls that are in the direction of desired information signals and moving said unwanted uplink nulls to other directions (preferably in the direction of interfering signals).

One of ordinary skill in the art would have been motivated to make this modification because such a categorization and movement of unwanted uplink nulls is

useful for reducing uplink interference and consequently allowing for higher uplink data rates.

Neither Youssefmir *et. al.* nor Bakhru discloses the practice of scaling the phases of antenna patterns according to a factor that is related to the ratio of the downlink operating frequency and the uplink operating frequency.

Dent discloses the practice of scaling the relative phases of antenna array element signals according to a factor that is related to the ratio of the uplink wavelength and the downlink wavelength (wavelength being inversely proportional to frequency) (Column 30 Lines 50-56) in the context of cellular/satellite communication system (Abstract).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* as modified by Bakhru by scaling the phases of wanted uplink nulls and corrected (shifted) unwanted uplink nulls according to a factor that is related to the ratio of the downlink operating frequency and the uplink operating frequency.

One of ordinary skill in the art would have been motivated to make this modification because it allows the optimization of system performance according to whatever uplink and downlink frequencies are being used, and thereby provides flexibility.

Regarding Claim 6, it was mentioned above, in the rejection of Claim 2, that Bakhru discloses that the antenna array's receiving pattern is steered so that the nulls are not in the direction of the desired information signal, but rather in the direction of

sources of interference, and the main lobes are in the direction of the desired information signals.

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Youssefmir *et. al.* in view of Bakhru, further in view of Dent, further in view of Toda, U.S. Patent No. 6,411,015.

Youssefmir *et. al.* in view of Bakhru, further in view of Dent discloses every limitation of Claim 2, upon which Claim 3 depends, as outlined above.

Neither Youssefmir *et. al.*, nor Bakhru, nor Dent discloses an antenna pattern minimum angle condition whereby said minimum angle is equal to the arcsine of an argument involving the ratio of a downlink wavelength to an element spacing.

Toda discloses a multiple piezoelectric transducer array (Abstract, Column 1 Line 66 to Column 2 Line 15). Toda discloses an electromagnetic pattern array condition for the angle between the main lobe and a side lobe, whereby $\theta = \arcsin(\lambda/P)$, where θ is the aforementioned angle, λ is the wavelength, and P is the spacing between elements of the array (Column 5 Lines 5-22, Fig. 7).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* as modified by Bakhru, further modified by Dent by categorizing an uplink null as bad if it satisfies the condition of being greater than an angle $\theta = \arcsin((\lambda_d/Z) - 1)$, whereby λ_d is the downlink wavelength and Z is the antenna array element spacing, and if its corresponding pseudo null in the downlink pattern lies within a specified proximity of the main beam position.

One of ordinary skill in the art would have been motivated to make this modification because it provides a precise means of determining whether or not a given uplink null is capable of hindering the performance of the communication system.

6. Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Youssefmir *et. al.* in view of Bakhru, further in view of Dent, further in view of Shafai, U.S. Patent No. 4,947,178.

Youssefmir *et. al.* in view of Bakhru, further in view of Dent discloses every limitation of Claim 3, upon which Claims 4-5 depend, as outlined above.

Neither Youssefmir *et. al.*, nor Bakhru, nor Dent expressly discloses the step of resetting an unwanted null to 0 degrees or to anywhere within an interval of directions centered on 0 degrees.

Shafai discloses a novel scanning array antenna (Abstract, Column 1 Lines 60-66). When this antenna moves from the $n = 1$ mode to higher order modes, a null is placed along the $\theta = 0$ degrees direction, where there was formerly a radiation peak for the $n = 1$ mode (Column 3 Lines 33-47, Figs. 1-2).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* as modified by Bakhru, further modified by Dent by providing a step whereby unwanted nulls in the antenna array radiation pattern are set to the $\theta = 0$ degrees direction (which is in the interval $[-X,X]$ for any real number X).

One of ordinary skill in the art would have been motivated to make this modification because the step whereby an unwanted null is moved helps to reduce interference, and thereby allows higher data rates in the communication system.

7. Claims 8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Youssefmir *et. al.* in view of Castellon *et. al.*, U.S. Patent No. 5,714,932.

Youssefmir *et. al.* discloses every limitation of Claim 7, upon which Claim 8 depends, as outlined above.

Youssefmir *et. al.* does not expressly state the separation between the elements of the array of the disclosed invention.

Castellon *et. al.* discloses an antenna array, the elements of which are less than or equal to one half of the RF carrier wavelength (Column 14 Lines 43-55, Fig. 1).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* by explicitly specifying element separations of less than or equal to one half of the downlink wavelength.

One of ordinary skill in the art would have been motivated to make this modification because it would help prevent unwanted nulls being in directions whereby the levels of power received by terminals in those directions are severely reduced.

Regarding Claim 10, one quarter of the sum of the downlink wavelength and the uplink wavelength is equal to the average value of one half of the downlink wavelength and one half of the uplink wavelength. Castellon *et. al.* discloses an antenna array, the

elements of which may be equal to one half of the RF carrier wavelength (Column 14 Lines 43-55, Fig. 1).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* by explicitly specifying element separations equal to one quarter of the sum of the downlink wavelength and the uplink wavelength.

One of ordinary skill in the art would have been motivated to make this modification as a way to attain an antenna array element spacing value that is approximately (due to the fact that the uplink frequency and the downlink frequency are usually relatively close) one half wavelength for both the uplink and the downlink, and thereby enjoy the null correcting advantages associated with one half wavelength array element spacing for both the uplink and the downlink.

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Youssefmir *et. al.* in view of Castellon *et. al.*, further in view of Bryanos *et. al.*, U.S. Patent No. 5,349,364.

Youssefmir *et. al.* does not expressly state the separation between the elements of the array of the disclosed invention.

Castellon *et. al.* discloses an antenna array, the elements of which are less than or equal to one half of the RF carrier wavelength (Column 14 Lines 43-55, Fig. 1).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* by explicitly

specifying element separations of less than or equal to one half of the uplink wavelength.

One of ordinary skill in the art would have been motivated to make this modification because it would help prevent unwanted nulls being in directions whereby the levels of power received from terminals in those directions are severely reduced.

Neither Youssefmir *et. al.* nor Castellon *et. al.* discloses separation between array elements greater than half of the carrier wavelength.

Bryanos *et. al.* teaches the use of an antenna array that provides beam scanning that has elements separated by more than one half of the wavelength (Column 1 Lines 18-42).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* as modified by Castellon *et. al.* by explicitly specifying element separations of greater than one half of the downlink wavelength.

One of ordinary skill in the art would have been motivated to make this modification because it would help prevent unwanted nulls being in directions whereby the levels of power received from and by terminals in those directions are severely reduced.

9. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Youssefmir *et. al.* in view of Dent, further in view of Bakhru.

Youssefmir *et. al.* discloses a method for adaptively constructing downlink signals in a frequency division duplex wireless communication system that comprises a

base station with a smart antenna array and a plurality of remote terminals (Abstract, Column 3 Line 66 to Column 4 Line 6, Column 4 Lines 32-37, Column 5 Line 64 to Column 6 Line 5). The base station smart antenna array receives combinations of uplink signals from the plurality of remote terminals (Column 6 Lines 12-16, Fig. 1). The uplink beamforming weight vector for a given remote terminal is estimated based on received uplink signals (Column 6 Lines 12-32, Column 10 Lines 24-34, Column 11 Lines 28-56). Uplink nulls and the uplink main beam position are identified from the uplink weights (Column 4 Lines 19-28, Column 18 Lines 4-10). Uplink null and beam information are used to appropriately place downlink nulls and in the computation of downlink beam weights (Column 17 Line 37 to Column 18 Line 10). A set of information signals is transmitted from the base station in accordance with the downlink beam weights (Column 3 Lines 20-23, Column 5 Line 64 to Column 6 Line 5).

Youssefmir *et. al.* does not expressly disclose the division of a communication cell into a plurality of sectors and the identification of uplink nulls that may yield a pseudo null in a given sector.

Dent teaches the practice of illuminating a cell from its geographic center, and dividing said cell into three 120 degree sectors (Column 1 Line 58 to Column 2 Line 10).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* by dividing the communication cell served by the antenna array into a plurality of sectors.

One of ordinary skill in the art would have been motivated to make this modification because it would help reduce interference and increase frequency re-use.

Neither Youssefmir *et. al.* nor Dent expressly discloses the identification of unwanted uplink nulls.

Bakhru teaches that a problem encountered with certain antenna arrays is the existence of a null in the exact direction that an information signal is being received (thus, an uplink signal) from, and that the disclosed invention remedies this problem (Column 1 Lines 39-46).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* as modified by Dent by providing for the identification of uplink nulls that may degrade performance in a given sector.

One of ordinary skill in the art would have been motivated to make this modification because it would help reduce interference and thereby improve uplink data rates.

10. Claims 12 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Youssefmir *et. al.* in view of Boros *et. al.*, U.S. Patent No. 6,615,024.

Youssefmir *et. al.* discloses a frequency division duplex wireless communication system that comprises a base station with a smart antenna array, capable of transmitting and receiving (uplink and downlink), and a plurality of remote terminals (Abstract, Column 3 Line 66 to Column 4 Line 6, Column 4 Lines 32-37, Column 5 Line 64 to Column 6 Line 5). The base station smart antenna array receives combinations of uplink signals from the plurality of remote terminals on different uplink channels (Column 6 Lines 12-16, Fig. 1). The uplink beamforming weight vector for a given

remote terminal is estimated based on received uplink signals (Column 6 Lines 12-32, Column 10 Lines 24-34, Column 11 Lines 28-56). Uplink nulls and the uplink main beam position are identified from the uplink weights (Column 4 Lines 19-28, Column 18 Lines 4-10). Uplink null and beam information are used to appropriately place downlink nulls and in the computation of downlink beam weights (Column 17 Line 37 to Column 18 Line 10). A set of information signals is transmitted from the base station in accordance with the downlink beam weights (Column 3 Lines 20-23, Column 5 Line 64 to Column 6 Line 5).

Youssefmir *et. al.* does not expressly discloses the presence of a downlink weight generator in the base station, nor the means to move downlinks nulls to a safe position.

Boros *et. al.* discloses a transmit weight generator for generating downlink weights based on differences between the phases and gains of the uplink and downlink signal paths, and the means to place nulls in positions so as to minimize interference to co-channel users (Column 13 Lines 19-49).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* by incorporating a downlink weight generator in the base station that generates downlink weights based on a signal's uplink characteristics, and giving said base station the means to move downlinks nulls to a safe position.

One of ordinary skill in the art would have been motivated to make this modification so that a high number of users in close proximity can use the wireless communication system.

11. Claims 14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Youssefmir *et. al.* in view of Boros *et. al.*, further in view of Dent.

Further in view of the rejection of Claim 12, which is nearly identical to Claim 14, Dent teaches the practice of illuminating a cell from its geographic center, and dividing said cell into three 120 degree sectors (Column 1 Line 58 to Column 2 Line 10).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Youssefmir *et. al.* as modified by Boros *et. al.* by dividing the communication cell served by the antenna array into a plurality of sectors.

One of ordinary skill in the art would have been motivated to make this modification because it would help reduce interference and increase frequency re-use.

12. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Castellon *et. al.* in view of Bryanos *et. al.*

Castellon *et. al.* discloses an antenna array, the elements of which are less than or equal to one half of the RF carrier wavelength (Column 14 Lines 43-55, Fig. 1).

Castellon *et. al.* does not expressly disclose separation between array elements greater than half of the carrier wavelength.

Bryanos *et. al.* teaches the use of an antenna array that provides beam scanning that has elements separated by more than one half of the wavelength (Column 1 Lines 18-42).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to modify the invention of Castellon *et. al.* by explicitly specifying element separations of greater than one half of the downlink wavelength.

One of ordinary skill in the art would have been motivated to make this modification because it would help prevent unwanted nulls being in directions whereby the levels of power received from and by terminals in those directions are severely reduced.

Response to Arguments

13. Applicant's arguments filed 31 October 2005 have been fully considered but they are not persuasive.

Regarding Applicant's arguments pertaining to Claim 1 on Page 12, Examiner maintains that downlink nulls are formed and downlinks weights computed based on uplink beam information (Column 17 Line 49 to Column 18 Line 1): "A useful <u>downlink transmission strategy under these conditions is to direct a beam towards the desired user and to direct nulls toward all interferers</u> that were received during the last several bursts, say N_T bursts. <u>Downlink weights</u> that substantially implement this strategy may be computed by setting Z_1 equal to the <u>last received burst that contains a signal from the desired user</u> [main beam], and setting Z_2 equal to the concatenation of these bursts within the last N_T <u>bursts that do not contain a signal from the desired user</u>

[nulls]. [Emphasis added by Examiner]" Clearly, uplink beam information is used to form the downlink beam pattern (main beam and null positions) and to compute the downlink weights.

Regarding Applicant's arguments pertaining to Claims 1 and 7 on Page 13, Examiner maintains that the cited limitations on Page 13 are disclosed by Youssefmir *et. al.* The limitations of Claim 1, "receiving at said base station antenna array combinations of arriving uplink signals from said plurality of remote terminals" and "estimating an uplink beamforming weight vector for each of said terminals from said combinations of arriving uplink signals" are clearly disclosed by Youssefmir *et. al.* at Column 6 Lines 12-32: "When receiving a signal from a subscriber (remote) unit, the signals received by each of the antenna array elements are combined by the adaptive smart antenna processing elements to provide an estimate of a signal received from that subscriber unit. In the preferred embodiment, the smart antenna processing comprises linear spatial processing, wherein each of the complex-valued (i.e., including in-phase I and quadrature Q components) signals received from the antenna elements is weighted in amplitude and phase by a weighting factor and the weighted signals are then summed to provide the signal estimate. The adaptive smart antenna processing scheme (i.e., the strategy) can then be described by a set of complex valued weights, one for each of the antenna elements. These complex valued weights can be described as a single complex valued vector of M elements, where M is the number of antenna elements. Thus, in the linear case, the smart antenna processing is designed to determine a set of weights such that the sum of the products of the weights times the

antenna element signals provides an estimate of the remote user's transmitted signal which satisfies some prescribed "estimation quality" measure. [Emphasis added by Examiner]" Clearly, for each terminal, an uplink beamforming weight vector is estimated based on the combinations of arriving uplink signals.

Regarding Applicant's argument pertaining to Claim 11 on Pages 14-15, Examiner maintains that the splitting of a communication system cell into a plurality of sectors is extremely well-known in the art. In particular, the cited reference, Dent, teaches the desirability of splitting a cell into sectors, reusing frequency sets in each sector, and avoiding interference between sectors (Column 2 Lines 46-60), and discloses the use of a directional antenna and various mathematical techniques to minimize such interference (Abstract). Additionally, Bakhru teaches the elimination of unwanted nulls near the direction of arrival of information signals (Column 1 Lines 39-46).

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew W. Genack whose telephone number is 571-272-7541. The examiner can normally be reached on FLEX.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Fan Tsang can be reached on 571-272-7547. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew Genack

Examiner

Art Unit 2645

Matthew Genack

1 February 2006

Fan Tsang

FAN TSANG
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600